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Guide to Use of Fertilizer in Central &
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PARTMENT OF AGRICULTURE

GUIDE TO USE OF

FERTILIZER

IN CENTRAL & NORTHERN ALBERTA

FERTILIZER
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Some important Factors in Fertilizer use

This publication provides a **general guide** to the use of fertilizers on crops under a variety of previous cropping conditions in each soil zone. Soil testing will provide a more accurate fertilizer requirement (see comments on page 3) for a particular field or cropping condition.

Fertilizer response should be assessed, whenever fertilizer is used. **Farmers should always leave a check or no fertilizer strip in each fertilized field every year.** One or more drill-width strips the length of the field some distance from the edge of the field makes an effective check strip. In many instances it is desirable to broadcast a number of rates of fertilizer in strips over drill-in applications in order to assess crop needs. For example, one can broadcast strips using nitrogen or potassium over drilled-in phosphate. Fertilizer test strips should be observed periodically during the growing season. The **yield** on the check and other strips should be determined at harvest time. Yield increases are difficult to estimate visually. Harvesting a swath from the centre of each strip is a suitable and convenient method of measuring the yields. (See your District Agriculturist for a leaflet showing how to use a 45 gallon drum to measure yields.

Some **precautions** on the use and handling of fertilizer: i) Do not allow livestock to lick spilled fertilizer of any kind, ii) Under certain conditions, rates of nitrogen alone higher than those recommended may cause accumulation of dangerously high levels of nitrate. The application of phosphorus with nitrogen will reduce nitrate accumulation by plants.

FERTILIZER APPLICATION AND PLACEMENT

NITROGEN — Nitrogen moves readily with soil moisture and therefore need not be drilled with the seed. Small amounts may be most effective when placed with the seed. However, there is a risk of seedling injury if too much is applied in this manner. The maximum rate which should be drilled in with the seed is shown in the recommendation tables. **Nitrogen fertilizer may be broadcast in the fall, early spring or during seedbed preparation and should be worked into the soil whenever possible.** If acute symptoms of nitrogen deficiency appear after emergence of cereal crops, a top dressing of nitrogen fertilizer prior to the shot blade stage is recommended.

PHOSPHORUS — Phosphorus fertilizer does not move readily in the soil so it must be placed within easy reach of the roots. It is best to drill phosphorus fertilizer near the seed. However, the germination of small seeded crops such as flax and rapeseed may be reduced by fertilizer placed near the seed. Maximum rates that should be drilled in with the seed of these are given in the recommendation table.

POTASSIUM — Potassium fertilizer will move in the soil to some extent. However, it is best applied in the drill row with the seed. The maximum amount which may be placed with the seed is about 30 pounds of K_2O.

Good equipment should be used when broadcasting or drilling in fertilizer to ensure even distribution, proper rates and effective placement of plant nutrients. **Mixing fertilizer in the seed drill box is not recommended.** For more information regarding fertilizer application see Publication 542, "Methods of Fertilizer Application".

Soil Testing Service

The Alberta Department of Agriculture provides a soil testing service to assist farmers in making sound soil management decisions by providing chemical soil tests and interpretations. Alberta soils vary greatly in their ability to supply plant nutrients and to support plant growth. This variation results from differences in parent materials, soil development and past management. Soil tests are designed to measure plant nutrient availability and to detect other soil problems which may affect crop growth.

Reliable soil test recommendations depend upon farmers taking **good representative samples** from each field. In addition, accurate and complete information on previous crop, fertilizer use, yields and soil management is also required with the soil samples. Detailed instructions, information sheets and sample containers are available from District Agriculturists offices and Fertilizer Dealers.

FACTORS TO CONSIDER WHEN CHOOSING A FERTILIZER PROGRAM

The use of fertilizer does not in itself guarantee good crops, but it should supplement other good management practices. Fertilizer recommendations are based on field tests conducted over a number of years on various crops, a variety of soils and under different management practices. The requirements for crops are given as a range of rates for each nutrient. Information from soil tests, responses obtained from test strips along with past experience will indicate the nutrients required and the degree they are limiting. The **low rate** should be used where the soil is known to be well supplied with this nutrient while the **high rate** should be used where the soil is strongly deficient. Where the soil is moderately supplied or no information or knowledge is known, use an **intermediate rate.**

Other factors to consider are the amount of soil moisture at seeding, rainfall, weed problems and previous crop and soil management practices. If the factors appear favourable and the soil is strongly deficient, response to high rates is likely. If one or more factors are unfavourable, the fertilizer rates should be reduced accordingly.

Economic factors to consider are crop market conditions, other opportunities for money and returns to investment in fertilizer. Three methods used to assess the economics of fertilizer are:

1. **Net returns per acre** to fertilizer (value of yield increase minus fertilizer cost).
2. **Return per dollar invested** (value of yield increase divided by fertilizer costs).
3. **Marginal Returns** (value of additional yield due to additional fertilizer minus the cost of additional fertilizer). The marginal returns approach clearly indicates the best return per dollar invested in fertilizer.

See your District Agriculturist for further information on fertilizer economics.

GUIDE TO FERTILIZER USE IN CENTRAL AND NORTHERN ALBERTA

NOTE: The rates of fertilizer for crops in the three major soil areas of central and northern Alberta are combined in one table. Note the remarks under the soil zone in which your farm is located before deciding on amounts and kinds of fertilizer you may use on a particular crop.

REMARKS:

Nitrogen and phosphorus: — The major nutrients generally limiting production are nitrogen and phosphorus. More nitrogen is usually required on Grey Wooded soils than on Dark Grey or Black soils. A cold, poorly drained soil may require higher rates of nitrogen than a warmer, well drained soil. On any particular soil, however, the amount of nitrogen required varies greatly with the condition of the land. For example, less nitrogen is required on summerfallow than on grain stubble or sod-breaking. The amount of phosphorus fertilizer required varies greatly among the different soils, but the previous cropping history and the amount of organic matter does not have much affect on the requirement for phosphorus. For a particular cropping condition on any soil the amount of nitrogen and phosphorus fertilizers required will also depend on the crop that is to be grown and on the climatic conditions (temperature and rainfall) of the growing season. Strip trials by the farmer and/or soil test can be useful in determining the requirements on a given farm.

Broadcast nitrogen is generally considered to be as effective as drilled in nitrogen. However, nitrogen must get to the root zone to be used by plants; therefore, where possible, broadcast nitrogen should be worked into the surface soil.

Potassium — Potassium is not usually limiting in most Alberta soils. Deficiencies occur in certain areas and soil types. Increases in cereal and potato yields have been obtained on some coarse textured and calcareous soils when potassium was used with high rates of nitrogen and phosphorus.

Sulphur — Some grey-wooded and dark-grey soils may be deficient in sulphur. Cereals as well as legumes may require the addition of sulphur. Poor crop growth even where high levels of nitrogen and phosphorus are used may indicate sulphur deficiency. **A soil test is now available to determine sulphur deficiency.** If a deficiency is suspected from soil test results or crop growth symptoms, a simple field test can be tried comparing a nitrogen-sulphur fertilizer with a nitrogen fertilizer using equal rates of nitrogen.

ADDITIONAL COMMENTS

(1) **Summerfallow** — Nitrogen accumulation under fallow is usually adequate for cereal crops. However, abnormally cool, wet, weedy conditions, growth of cover crop or green feed during the fallow year may result in below average nitrogen accumulation. A soil test will indicate whether adequate nitrogen accumulation has occurred.

Legume-sod fallow: — The amount of nitrogen available will be dependent on the density and condition of the legume stand (innoculation is important), the time of sod-breaking and the amount of cultivation following sod-breaking. Early breaking and well worked sod will require less nitrogen.

Stubble & Breaking: — Fall worked stubble will require less nitrogen than spring worked stubble. Early grass sod or bushland breaking should also require less than late breaking. The amount of working will also affect the nitrogen required. The conditions mentioned under nitrogen should also be taken into account when choosing the nitrogen level for stubble cropping.

(2) **Grass (for seed):** — Fertilizer is usually not required for the first seed crop if the grass is seeded on fallow without a companion crop. About 30 lb. nitrogen/acre is generally sufficient for the first seed crop when seeded with a companion on the Dark Grey soils. Fescue seeded with a companion crop usually does not set seed the following year, and nitrogen fertilizer is not required until the fall of the first year after seeding. Other grasses, particularly timothy, will produce seed the year after seeding and should be fertilized with nitrogen after harvesting of the companion crop or the following spring. For second and third crops of grass seed, the amount of nitrogen could be increased and for older stands of grasses such as timothy and bromegrass, phosphorus fertilizer may also be beneficial. Rejuvenated fescue stands may also require the addition of phosphorus.

(3) **Grass & Legume Mixtures (for hay or forage):** — The ratio of nitrogen to phosphorus required is dependent to a large extent on the grass to legume ratio. With a higher amount of grass, more nitrogen and less phosphorus is required, while more phosphorus and less nitrogen would be used on stands predominantly legume.

(4) **Legumes (for seed):** — Limited work with these crops has shown that the primary need is for phosphorus. On soils very low in available nitrogen, the addition of nitrogen with phosphorus may aid in establishment of the legume.

(5) **Potatoes & Garden Vegetables:** — In the home garden fertilizers can also be very beneficial. In general a complete fertilizer with nitrogen, phosphorus and potassium should be used. Suggested rates are 100 to 200 lb./acre of 10-30-10 or 14-14-7. If the garden is heavily manured the major lack is phosphorus and the requirement could be met by using 100 lb./acre of 11-48-0. Fertilizers should be broadcast and worked in prior to seeding or placed beside or below the seed because most garden seeds are quite sensitive to fertilizer drilled in with the seed.

(6) **Solonetzic Soils:** — Solonetzic soils differ from other soils with a high salt content, shallow top soil, poor drainage, low nitrogen content and other characteristics. Hay crops are generally very responsive to broadcast nitrogen. Cereal crops are more responsive to nitrogen and phosphorus drilled in with the seed (such as 27-14-0 or some other high nitrogen fertilizer) than to broadcast applications. Those farming Solonetzic soils should obtain the publication, "Solonetzic Soils and Their Management", available from their District Agriculturist's offices, or by contacting the Solonetzic Soil Substation, Vegreville, Alberta.

(7) **Soil Acidity:** — Soil acidity is a problem in some soils. Where barley grows poorly even when properly fertilized, and where alfalfa grows very poorly, the problem may be acidity. A soil test will show if the soil is acid. Crops vary greatly in their tolerance of soil acidity. Oats are least sensitive to soil acidity followed by flax, wheat, rapeseed and barley. Grasses are less sensitive than legumes. Timothy, fescue, bluegrass, alsike and red clover are among the most tolerant forage crops.

BLACK AND DARK GREY WOODED SOILS OF CENTRAL ALBERTA

Remarks: Soils in this zone are generally quite productive when fertilized. Every effort should be taken to improve and maintain their fertility. Moisture is generally not as limiting to crop production as in the area to the south and east of this zone. The higher rates of fertilizer application are suggested where previous experience has shown good responses and other management practices are geared to high yields. Some of these practices may include the use of grass-legume crops in rotation, application of farm manure and the return of straw and stubble to the soil.

There have been a number of instances where potassium fertilizer has given response particularly with cereals on soils with coarse texture or restricted sub-soil drainage. A soil test is helpful in determining if potassium is needed.

GREY WOODED SOILS OF CENTRAL ALBERTA

Remarks: Grey wooded soils were developed under cool, humid conditions and the surface layer of some soils are highly leached of clay and plant nutrients. They are generally low in initial fertility and organic matter and therefore require special or more intensive management in order to be satisfactorily productive. **Moisture is not as limiting** as elsewhere in Alberta, however **the growing season is substantially shorter** in this zone.

The lower rate is the minimum amount that should be applied to all grey soils with economic returns expected in most instances. **Cereal crop yields are greatly improved when grown in rotation with grasses and legumes.** Seedling emergence may be reduced by soil "crusting". Soil crusting can be reduced by increasing the level of organic matter.

Many grey wooded and some dark grey wooded soils are deficient in sulphur. One-half to three-quarters of the area of grey soils will respond to sulphur applied to legumes. Other crops such as cereals may also respond to additions of sulphur and use of sulphur-containing fertilizers is advised where a soil is known to show sulphur response on legume crops.

The potassium levels are generally adequate, however on some soils with coarse texture or restricted sub-soil drainage, responses to added potash have been noted on cereal crops. A soil test is helpful in determining if potassium is needed.

DARK GREY AND GREY WOODED SOILS OF THE PEACE RIVER REGION

Remarks: The agricultural soils in the Peace River region range from Black, developed under grassland, to Grey Wooded, which developed under forest vegetation. Although the Black and Dark Grey soils are relatively fertile, good management and fertilizer usage increases crop yields. The Grey soils are generally low in initial fertility and require special management to be productive. Soil low in organic matter and high clay content are particularly difficult to manage and **cultivation operations have to be timed according to soil moisture content.** On these, soil improving crops such as legumes or grass-legume mixtures in rotations, incorporation of crop residues, additions of manure, all are helpful practices to improve the physical condition and reduce erosion and surface crusting.

The fertilizer recommendations outlined are given as a range of rates. The lower rate is the minimum amount that should be applied to all soils in this region. The higher rates are suggested where good responses have occurred and management practices are geared to high yields. Low moisture or soil crusting can reduce yields.

Potassium is not required on most crops. Large increases in the yield of potatoes have been obtained on sandy, calcareous soils with potassium when used with rates of nitrogen and phosphorus.

Sulphur may be deficient for cereal and legumes on some soils.

FERTILIZER RATES FOR CROPS IN CENTRAL AND NORTHERN ALBERTA

The area to the north and west of a line through Lloydminster, Stettler, Carstairs and Pincher Creek.

(See Page 7 to convert these rates to commercial fertilizer rates)

Crop	Previous Crop	RATE: Pounds of nutrients per acre				Method of Application and Suggestions
		Nitrogen (N)	Phosphorus (P_2O_5)	Potassium (K_2O)	Sulphur (S)	
Wheat **Oats** **Barley** **Fall Rye**	Fallow or after early (to June 15) sod or brush breaking (1)*	5 - 20	20 - 30	0	0 - 10	Drill in fertilizer at seeding. The higher rate of nitrogen should be used when soil is low in organic matter, if temperature was low, rainfall was high or land was weedy and not well cultivated during the fallow year.
	Sod or brush breaking (June 15 - Aug. 1)	20 - 30	20 - 30	0	0 - 10	Up to 25 pounds of nitrogen may be drilled in with the seed into dry soil, 30 pounds if seed-bed is moist, higher rates must be broadcast. Drill in phosphorus fertilizer.
	Stubble or after late (Aug. 1) sod or brush breaking	30 - 60	20 - 30	0	0 - 10	Up to 25 pounds of nitrogen may be drilled in with the seed into dry soil, 30 pounds if seed-bed is moist, higher rates must be broadcast. Drill in phosphorus fertilizer. On fall seeded crops, phosphorus should be drilled in at seeding and the nitrogen broadcast early the following spring.
Flax	Fallow	5 - 10	15 - 20	0	0 - 10	Drill in fertilizer at seeding.
	Stubble, late sod or brush breaking	20 - 40	15 - 20	0	0 - 10	From 10 to 12 pounds of nitrogen may be drilled in with the seed, higher rates must be broadcast. The safe maximum rate is 20 pounds of phosphorus.
Mustard **Rapeseed**	Fallow	5 - 20	15 - 20	0	0 - 10	Drill in fertilizer at seeding.
	Stubble, late sod or brush breaking	30 - 60	15 - 20	0	0 - 10	From 10 to 12 pounds of nitrogen may be drilled in with the seed, higher rates must be broadcast. The safe maximum rate is 20 pounds of phosphorus.
Grass	For seed (2)*	30 - 60**	0 - 30	0	0 - 10	Broadcast fertilizer after seed harvest or in fall. Applications of phosphorus at the higher rates may not be necessary every year.
	For hay or pasture (with less than 10% legume)	40 - 100	10 - 40	0	0 - 10	Broadcast fertilizer in fall or early spring. Applications of phosphorus at the higher rates may not be necessary every year.
Grass-legume mixtures	For hay or pasture (3)* 10% - 25% legume	25 - 60	20 - 40	0	0 - 20	Broadcast fertilizer in late fall or early spring.
	Over 25% legume	10 - 30	40 - 60	0	0 - 20	Broadcast fertilizer in late fall or early spring.
Legumes	For seed (4)*	10 - 20	30 - 60	0	0 - 20	Broadcast fertilizer in late fall or early spring.
Potatoes (5)*	Fallow	25 - 50	40 - 80	30 - 50	0	Fertilizer should be banded 1" to 2" away from the seed row.
	Cereals, stubble or after potatoes	60 - 100	50 - 100	50 - 100	0	

* Please refer to Additional Comments on Pages 4 and 5.

** No fertilizer required for first seed crop if grass seeded on fallow without companion crop.

A TABLE TO ASSIST IN SELECTING FERTILIZERS FOR REQUIRED AMOUNTS OF NUTRIENTS

(The number in the columns after a particular fertilizer formulation refers to the number of pounds of that fertilizer required to supply a required amount of nutrient.)

Fertilizer Formulation	POUNDS OF NITROGEN (N) REQUIRED**									
	5	10	15	20	25	30	35	40	45	50
21-0-0	24	48	72	95	119	143	167	190	214	238
34-0-0	15	29	44	59	74	88	103	118	132	147
46-0-0	11	22	33	44	54	65	76	87	98	109
82-0-0	*	*	18	24	30	37	43	49	55	61
27-14-0 or 26-13-0	19	37	56	74	93	111	130	148	166	185
23-23-0	22	44	65	87	109	130	152	174	196	217
16-20-0	31	63	94	125	156	*	*	*	*	*
10-30-10	50	100	150	200	*	*	*	*	*	*

	POUNDS OF PHOSPHORUS (P_2O_5) REQUIRED**									
	5	10	15	20	25	30	35	40	45	50
11-55-0	9	18	27	36	45	55	64	73	82	91
11-48-0	10	20	30	40	50	60	70	80	90	100
10-30-10	17	33	50	67	83	100	117	133	150	167
23-23-0	22	44	66	87	109	130	152	174	196	217
16-20-0	25	50	75	100	125	150	175	200	225	250
27-14-0 or 26-13-0	36	71	107	143	179	*	*	*	*	*
8-24-24	21	42	63	83	104	125	146	167	188	208

	POUNDS OF POTASSIUM (K_2O) REQUIRED**					
	5	10	15	20	25	30
10-30-10	50	100	150	200	250	300
13-13-13	38	77	115	154	192	230
14-14-7	72	144	216	*	*	*
13-16-10	50	100	150	200	250	300
8-24-24	20	40	60	80	100	125

	POUNDS OF SULPHUR (S) REQUIRED**					
	5	10	15	20	25	30
21-0-0 (24% S)	20	40	60	80	100	120
16-20-0 (14% S)	36	71	107	143	180	*
34-0-0 (S) (11% S)	48	95	140	*	*	*
10-30-10 (5% S)	100	200	*	*	*	*
Gypsum (18% S)	27	55	82	110	137	165

* Some other fertilizer formulation is more desirable to supply this quantity of nutrient.

** Note: These tables consider each nutrient separately and in many instances amounts of fertilizer shown may not be safe to drill-in with the seed or amounts of the other nutrients in a particular formulation may be harmful to seedlings. See method of application column in tables on previous pages.

For more detailed information on fertilizer use on various crops and other soil problems, a copy of, "Soil Management in Alberta", Publication No. 510, is available from your District Agriculturist.

This publication was prepared by members of the Alberta Soil Testing Committee.

Copies of this publication may be obtained from: Publications Office, Alberta Department of Agriculture, Agriculture Building, 9718 - 107th Street, Edmonton, Alberta or from your District Agriculturist.